User manual for PZ5 devices

Digital processor controlled arithmetic panel meter:

Two measuring inputs with calculation:

x = (In1 + In2)	* K
x = (In1 - In2)	* K
x = (In1 * In2)	* K
x = (In1 / In2)	* K
x = (In1 * 100 / In2)	* K

Technical features:

- display from -9999…99999
- MIN / MAX value recording
- 30 points linearisation per channel
- permanent cable breakage monitoring
- optical setpoint display
- Hold- /Tara-function via keypad or digital input
- configurable channel switching

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1. Identification

STANDARD TYPES	ORDER NUMBER
Supply 230 VAC	**PZ5.0001.1540C**
Supply 115 VAC	**PZ5.0001.1440C**
Supply 24 VDC (galvanic insulated)	**PZ5.0001.1740C**

Options – breakdown of order code:

	P	Z	5	0	0	0	1	1	5	4	0	C

Basic type	**P**		
Standard device type			
Two standard signal inputs	**Z**		
Number of digits			
5 digits	**5**		
Interface			
no	**0**		
RS232	**2**		
RS232 (galvanic insulated)	**3**		
RS485 (galvanic insulated)	**4**		
Sensor supply			
no	**0**		
10 V / 20 mA	**2**		
24 V / 50 mA	**3**		
Outputs			
no	**0**		
0-10 V	**1**		
0-20 mA	**2**		
4-20 mA	**3**		
		Internal index	
		Setpoints	
		0	no setpoint
		2	2 relay outputs
		4	4 relay outputs
		Mechanical options	
		1	IP65, foil key pad, screw clamp
		4	IP54, foil key pad, screw clamp
		7	IP65, foil key pad, plug-in clamp
		9	IP54, foil key pad, plug-in clamp
		Supply voltage	
		4	115 VAC
		5	230 VAC
		7	24 VDC (galv. insulated)
		Housing size	
		1	96x48 mm
		Measuring input	
		1	Current, voltage

Please state physical unit by order, e.g. m/min.

2. Technical data

Housing	
Dimensions	96x48x134 mm (BxHxD) including plug-in terminal
	96x48x148 mm (BxHxD) including plug-in terminal
Panel cut-out	$92.0^{+0.8}$ x $45.0^{+0.6}$ mm
Wall thickness	from 0 up to 50 mm
Fixing	snap-in screw element
Material	PC / ABS-Blend, black, UL94V-0
Protection class	standard IP54 (Front), IP00 (Back side)
Weight	ca. 450 g
Connection	Srew clamp / plug-in terminal; line cross section up to 2.5 mm^2
Display	
Digit height	14 mm
Segment colour	red
Range of display	-9999 to 99999
Setpoints	1 LED per setpoint
Overflow	horizontal bars at the top
Underflow	horizontal bars at the bottom
Display time	0.04 to 10 seconds
Input	
Measuring range	0…10 V and 0/4…20 mA
Input resistance	0…10 V R_I = ~ 150 kΩ
	0/4…20 mA R_I = ~ 50 Ω
Measuring error at measuring time = 1 sec	0.02 % v. MB ± 1 Digit T_U = 20…40°C
Temperature drift at TU < 20°C bzw. > 40°C	all measuring inputs 50 ppm/K
Measuring time	1 channel 0.1…10.00 seconds 2 channels 0.2…10.00 seconds
Measuring principle	Sigma / Delta
Resolution	24 bit
Output	
Relay	Switch-over contact 230 VAC / 5 A; 30 VDC / 2 A at ohm resistive load
Switching cycles	0.5 * 10^5 at max. contact load 5 * 10^6 mechanically Separation as per DIN EN 50178 / characteristic data as per DIN EN 60255

Output	
Analog output	0...10 V (12-bit) load ≥ 10 kΩ 0...20 mA (12-bit) load ≤500 Ω 4...20 mA (12-bit) load ≤500 Ω
Internal resistance	100 Ω at 0 - 10 VDC analog output
Error	0.1 % % in the range TU= 20...40°C, beyond 50 ppm/K
Sensor supply (galvanic insulated)	10 VDC, 20 mA 24 VDC, 50 mA
Interface	
Protocol	manufacturer-specific ASCII
RS232 (optionally galv.insulated)	9600 Baud, no parity, 8 databits, 1 stopbit , ASCII protocol
Lead length	max. 3 m
RS485 (galv. insulated)	9600 Baud, no parity, 8 databits, 1 stopbit , ASCII protocol
Lead length	max. 1000 m
Power Pack	
Supply voltage (galvanic insulated)	230 VAC / 50/60 Hz / ±10 % 115 VAC / 50/60 Hz / ±10 % 24 VDC / ±10 %
Power consumption	**max. 15 VA**
Memory	Parameter memory EEPROM
Data life	>100 years
Ambient conditions	
Working temperature	0...60 °C
Storing temperature	-20...80 °C
Climatic density	rel. humidity ≤75 % on years average without dew
EMV	DIN 61326
CE-sign	conformity to 89/336/EWG
Safety standard	DIN 61010

3. Safety advices

Please read the users guide and *chapter 4* before installation and keep it for future reference.

Proper use

The **PZ5** is designed for the evaluation and display of transmitter signals (standard signals). With the set points, it is possible to perform simple control tasks .

Caution! Careless use or improper operation can result in personal injury and/or damage to the equipment!

Control of the device

The panel meters are checked before dispatch and sent out in perfect condition. Should there be any visible damage, we recommend close examination of the packaging. Please inform the supplier immediately of any damage .

Installation

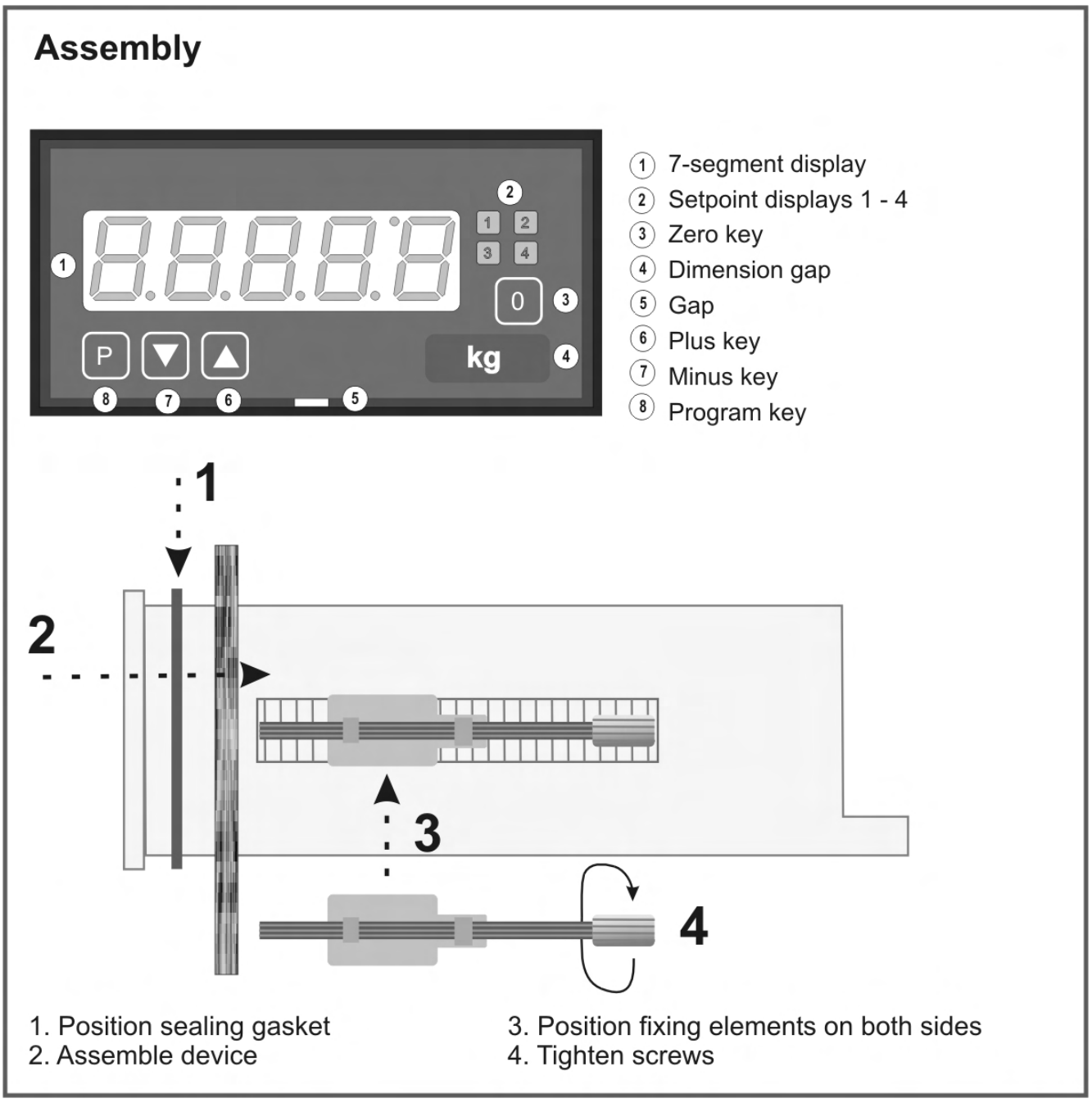
The **PZ5** must be installed by a suitably **qualified specialist** (e.g. with a qualification in industrial electronics) .

Notes on installation

- There must be no magnetic or electric fields in the vicinity of the device, e.g. due to transformers, mobile phones or electrostatic discharge.
- The **fuse rating** of the supply voltage should not exceed a value of **6A N.B. fuse**.
- Do not install **inductive consumers** (relays, solenoid valves etc.) near the device and **suppress** any interference with the aid of RC spark extinguishing combinations or free-wheeling diodes.
- Keep input, output and supply lines separate from one another and do not lay them parallel with each other. Position “go” and “return lines” next to one another. Where possible use twisted pair. So, you receive best measuring results.
- Screen off and twist sensor lines. Do not lay current-carrying lines in the vicinity. Connect the **screening on one side** on a suitable potential equaliser (normally signal ground).
- The device is not suitable for installation in areas where there is a risk of explosion.
- Any electrical connection deviating from the connection diagram can endanger human life and/or can destroy the equipment.

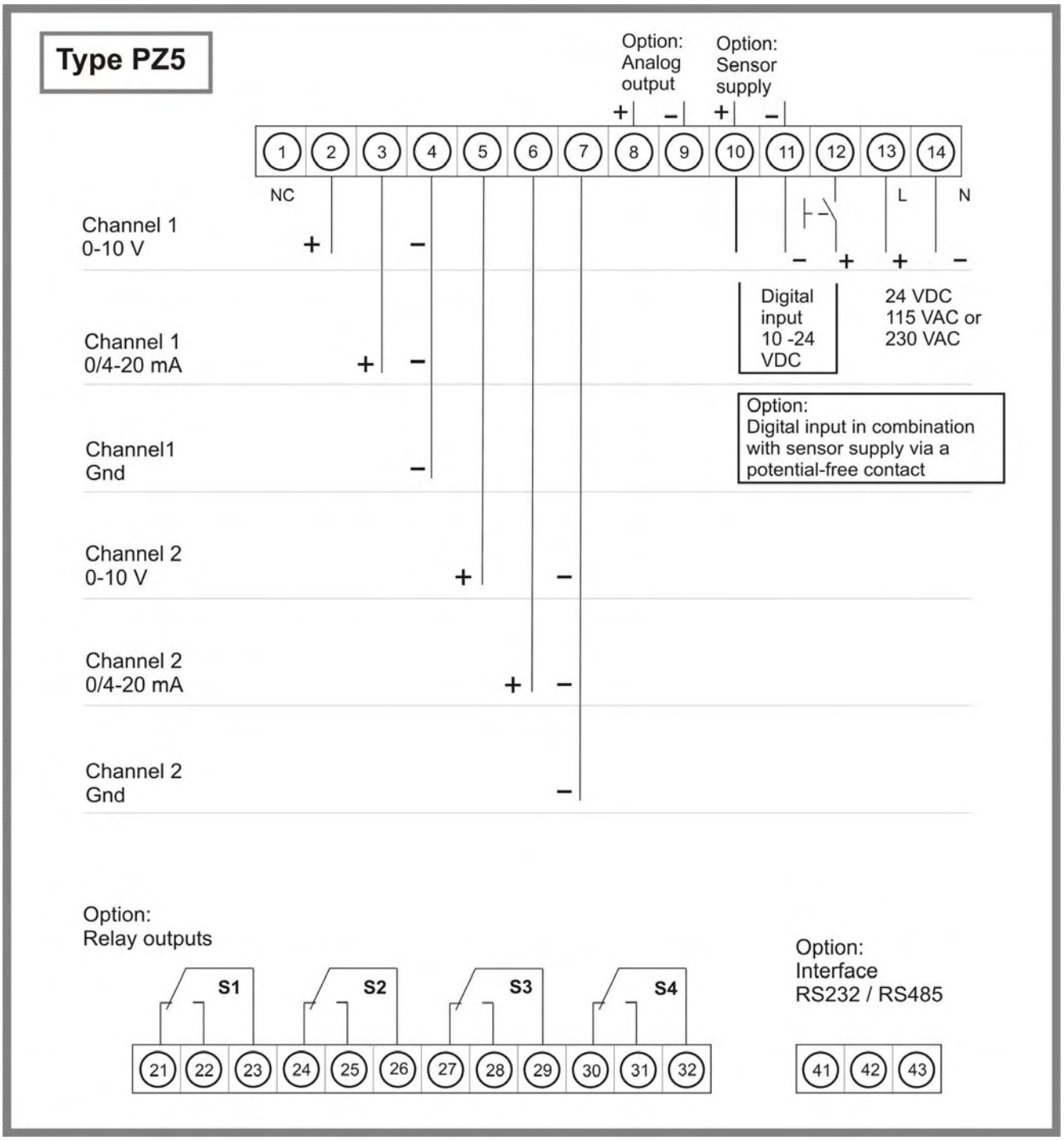
- Do not install several devices immediately above one another or in an extremely thermal isolated housing. Due to the internal heat dissipation of the decives, the recommended ambient temperature can be excessed.
- The terminal area of the devices is part of the service. Here electrostatic discharge needs to be avoided. Attention! High voltages can cause dangerous body currents.
- Galvanic insulated potentials within one complex need to be placed on a appropriate point (normally earth or machines ground). So, a lower disturbance sensibility against impacted energy can be reached and dangerous potentials, that can occur on long lines or due to faulty wiring, can be avoided.

4. Assembly



Type Front frame	Panel cut out (BxH) in mm	Assembly grid horizontally	Assembly grid vertically
96x48 mm	$92.0^{+0.8}$ x $45.00^{+0.6}$	120 mm (recommended)	96 mm (recommended)

5. Electrical connection

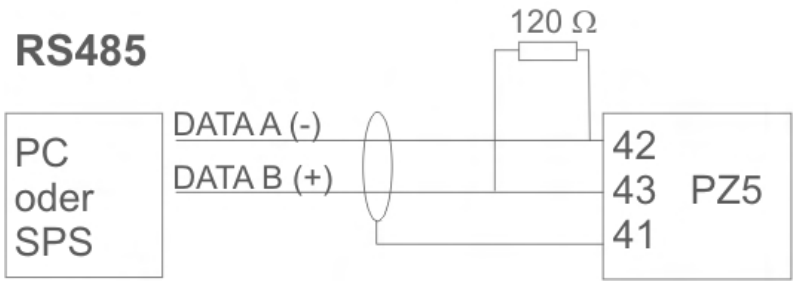


Interface connection

The lines for the **RS232** interface must be connected 1:1, TxD to TxD und RxD to RxD.

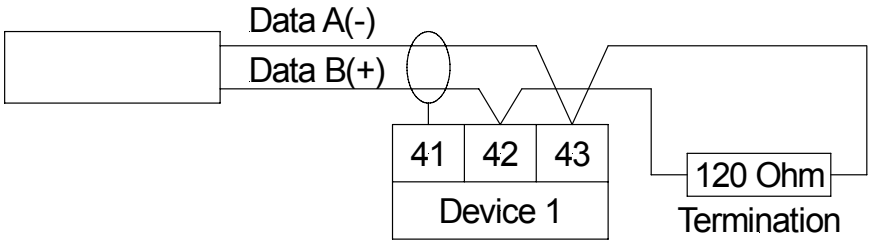
Connection pattern PC or SPS ⇔ **PZ5**

The interface **RS485** is connected via a screened data line with twisted wires (**Twisted**-**Pair**). A termination of the bus wire musst be connected at the end of each bus segments. This is neccessary to guarantee a safe data transfer on the Bus. Therefor a resistance (120 Ohm) is inserted between the wires Data B (+) and Data A (–).



Caution!

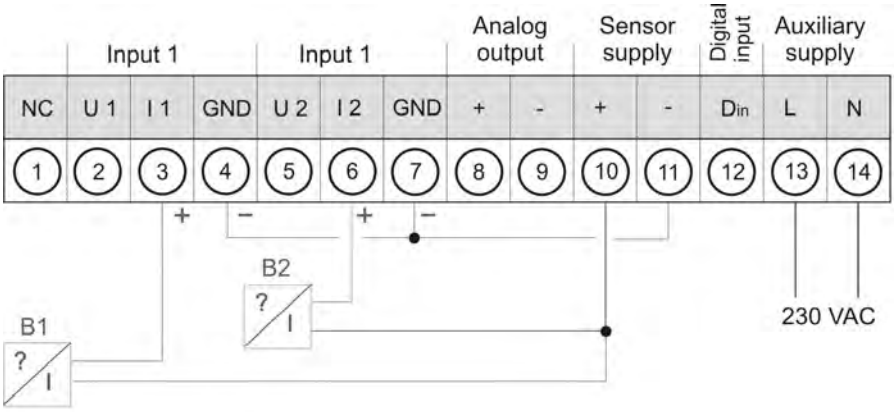
The potential reference can lead to a compensating current
(interface ⇔ measuring input) with a non-galvanic insulated interface and can thus affect the measuring signals.



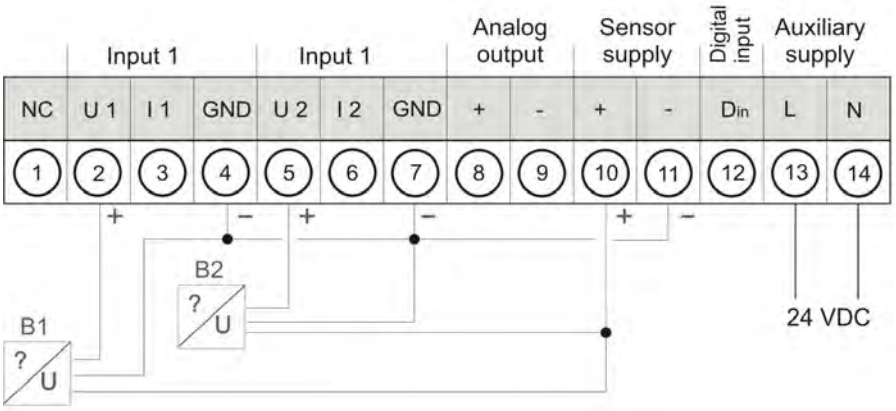
Connection examples

This section gives a few examples of practical connections. Other connection options can be combined from the various examples

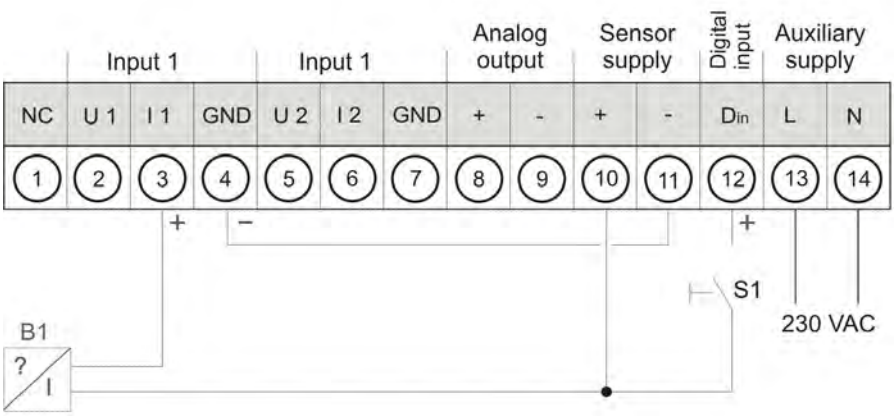
Co-channel measuremtn with current signals, supply 230 VAC:



Co-channel measuremtn with voltage signals, supply 24 VDC:

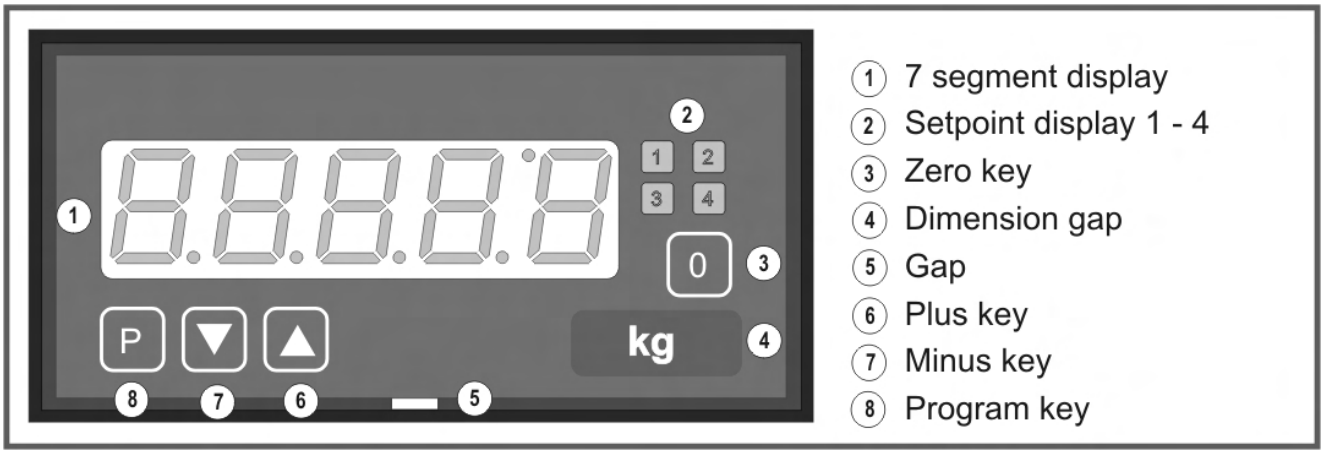


One-channel measurement with current signal in combination with digital input and sensor supply, voltage supply 230 VAC:



6. Operation and function description

6.1. Operation



Display (1)	
7 segment display	5-digit, red
Digit height	14 mm
Display range	-9999…99999
Decimal points	none, 1, 2, 3, 4 (adjustable)
Setpoint displays (2)	
Optical threshold message	4 LED, red
Keys (6), (7), (8), and (3)	
P	Programming mode
▲	Increase of value range
▼	Decrease of value range
P + ▼	Address Next lower program number
P + ▲	Address Next higher program number
0	Activation of TARA or HOLD, Reset for MIN/MAX permanent
Dimension gap (4) for physical unit	
Variable dimension strip	Dimension on demand e.g. kg, m³…

Switching on

Before switching on, check all the electrical connections to make sure they are correct. On completion of the installation, the device can be switched on by applying the supply voltage.

Starting sequence

During the switching-on process, a segment test is performed for approx. 1 second, whereby all LED on the front (including setpoint LED) are triggered. After this, the type of software is indicated for approx. 1 second and then, also for 1 second, the software version. After the starting procedure, the unit changes to operation/display mode.

MIN-/MAX memory

The measured minimum and maximum values are saved in a volatile memory in the unit and get lost when the unit is switched off.
You can call up the contents of the memory by pushing (less than 1 second) the [▲] or [▼] key. The relevant value is indicated for approx. 7 seconds. By briefly pressing the same key again, you will return immediately to the display mode.

▲ ⇒ Display of MAX value
▼ ⇒ Display MIN value

You can erase the value shown in the display by simultaneously operating the [▲] and [▼] keys. The erasure is acknowledged by horizontal bars. The content of the memory will be lost with switching-off of the device.

Display switch-over between two input channels

For the **PZ5** device it is possible to swith temporarily between the different channels via keypad. Push the [▼] - or [▲]-key for longer then 1 second, this leads to a switch-over to the next channel. The channels can be run through forwards with key [▲] or backwards with key [▼].

Display:	Channel 1	Ch1	
	Channel 2	Ch2	
	Arithmetic	Ar	
	Channel 1	Ch1	and so on...

Example:

Under program number (PN15≥3) the calculation (Ar) is parametrised as a permantent display. The input value for channel 1 shall be displayed:
Push the [▲] key for at least one second. The **PZ5** device acknowledges the change to channel 1 by shortly displaying Ch1, thereupon you can stop pushing the key. The input value of channel 1 is shown for approx. 7 seconds in the display, then the display changes back to the parametrised display (arithmetic Ar). This operation is confirmed by „**Ar**“ in the display. To recall all channels, the key [▲] or [▼] needs to be detached in the meantime.

Overflow/Underflow of the arthmetic result

During the channel calculation the comma (PN18) is included in the calculation as decimal point. Each over- or underflow of a channel leads in the calculation to a defined display. This defined setting ensures that the corresponding set points go into a defined state.

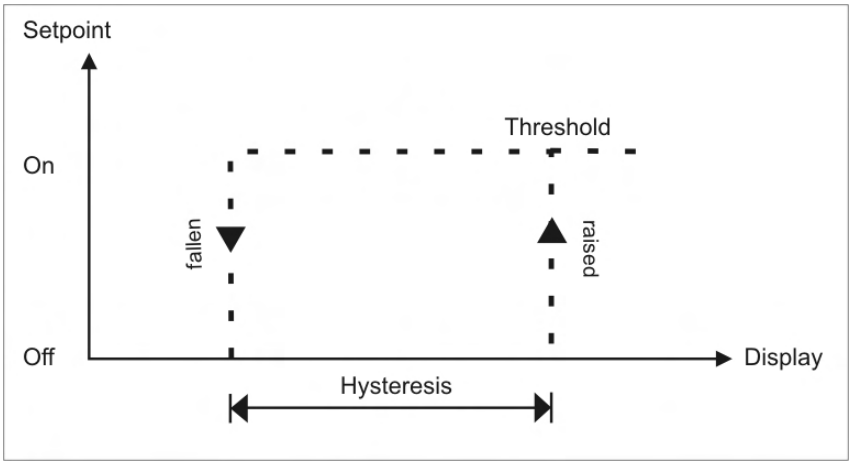
Formula	Channel 1	Channel 2	Result
(Channel 1 + Channel 2) * Contant	Overflow	OK or overflow	Overflow
(Channel 1 + Channel 2) * Contant	Underflow	OK or underflow	Underflow
(Channel 1 + Channel 2) * Contant	OK or overflow	Overflow	Overflow
(Channel 1 + Channel 2) * Contant	OK or underflow	Underflow	Underflow
(Channel 1 + Channel 2) * Contant	Overflow	Underflow	Overflow
(Channel 1 – Channel 2) * Contant	Overflow	OK or underflow	Overflow
(Channel 1 – Channel 2) * Contant	Underflow	OK or overflow	Underflow
(Channel 1 – Channel 2) * Contant	OK or overflow	Underflow	Overflow
(Channel 1 – Channel 2) * Contant	OK or underflow	Overflow	Underflow
(Channel 1 – Channel 2) * Contant	Underflow/Overflow	Underflow/Overflow	Overflow
(Channel 1 * Channel 2) * Contant	Overflow	OK or overflow	Overflow
(Channel 1 * Channel 2) * Contant	Underflow	OK or underflow	Underflow
(Channel 1 * Channel 2) * Contant	OK or overflow	Overflow	Overflow
(Channel 1 * Channel 2) * Contant	OK or underflow	Underflow	Underflow
(Channel 1 * Channel 2) * Contant	Overflow	Underflow	Overflow
(Channel 1 / Channel 2) * Contant	Overflow	Optional	Overflow
(Channel 1 / Channel 2) * Contant	Underflow	Optional	Underflow
(Channel 1 / Channel 2) * Contant	OK	Overflow	Underflow
(Channel 1 / Channel 2) * Contant	OK	Underflow	Underflow
(Channel 1 * 100 / Channel 2)	Overflow	Optional	Overflow
(Channel 1 * 100 / Channel 2)	Underflow	Optional	Underflow
(Channel 1 * 100 / Channel 2)	OK	Overflow	Underflow
(Channel 1 * 100 / Channel 2)	OK	Underflow	Underflow

Overflow / Underflow	
Overflow	horizontal bars are displayed on the top of the display
Underflow	horizontal bars are displayed at the bottom of the display

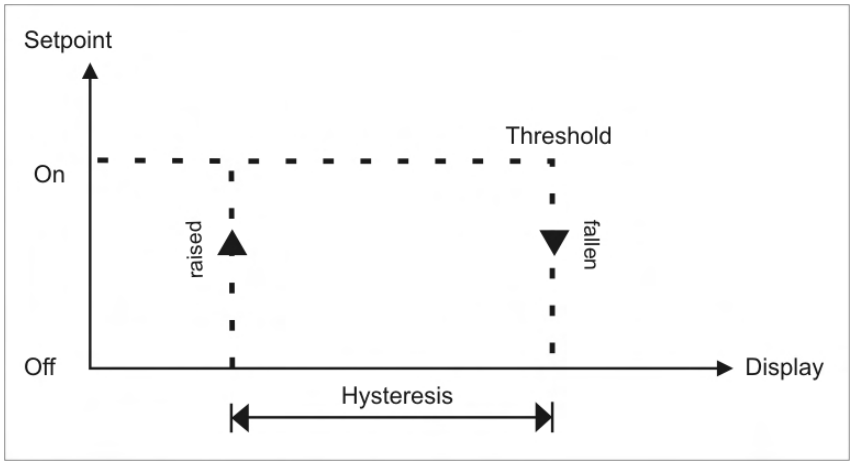
6.2 Alarms / Relays

An active relay, or an activated setpoint is indicated by a flashing of the relevant setpoint LED, which you find directly next to the 7-segment display.

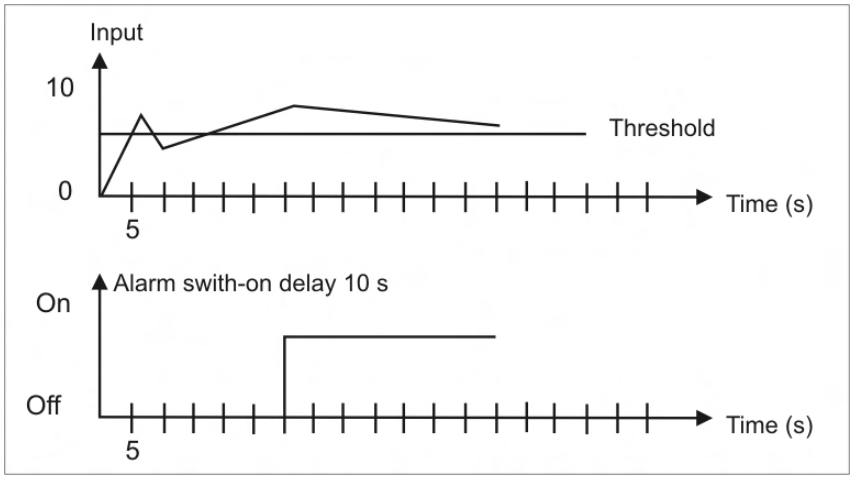
Functional principle of alarms / relays	
Alarm / Relay X	Channel 1, Channel 2, arithmetic calculation
Threshold	Switch-over threshold value
Hysterisis	Width of window between switching threshold
Working principle	Operating current / quiescent current
Switch-on delay	Time between reaching the threshold and the resultant switching on of the relay.
Swith-off delay	Time between reaching the threshold and the resultant switching off of the relay.
Alarm confirmation	Switch-on or switch-off interlock and rejection at activated digital input or zero key



Operating current
Relays S1-S4 are off below the threshold and on on reaching the threshold.



Quiescent current
Relays S1-S4 are on below the threshold and switched off on reaching the threshold.



Swith-on delay
The relay S1-S4 is on 10 seconds after reaching the threshold; briefly exceeding the threshold does not lead to the relay being switched on. The switch-off delay functions in a similar manner, in other words it keeps the set point switched on until the parameterised time has elapsed.

Allocation of the alarms to a certain actuate value

As it is not always desired that alarms follow the operating mode, the outputs can be assigned to the minimal-/maximal value or any other value. Therefor the adjustable value range is assigned to the according program number (PN60, PN70, PN80 and PN90).

Alarms 1-4	
Mode	**Actuate value**
0	none
1	Channel 1
2	Channel 2
3	Arithmetic function

Optical response, flashing display

If one or some thresholds are broken, the flashing of the alarm LED can amplify the optical response by assignment of the threshold PN59 to the 7 segment display.

Example:
The threshold for flashing of the display is set at setpoint 2.
If setpoint 1 is exceeded and set point 2 is not, the setpoint **LED 1** lights up permanently.
If setpoint 2 exceeds the threshold, the 7-segment display will start to flash, setpoint 1 will light up permanently and set point LED 2 will flash.
The flashing enhances the optical response and the operator sees immediately that an important threshold has been exceeded with this unit.

6.3 Analogausgang

The optional analogue output is used for the transduction of a measuring value, supported by a standard signal of 0…10 V or 0/4…20 mA. The analogue output is paramerterised via the two program numbers PN20 final value (fullscale) and PN21 initial value (Offset). At the initial value, the value is set at which the analogue output transmits the minimal value (0 V or 0/4 mA) , and at the final value, the value at which the output transmits its maximum (10 V or 20 mA).
By this means it is possible to re-scale the input signal of a transducer or even to convert it into another standard signal. The analogue output can be set on channel 1, channel 2 or the arithmetic value via the actuate value PN22. The analogue output is updated within the cycle of the measuring time. At a high measuring rate, smaller cycle fluctuations of some milli-seconds are possible.

6.4. Digital input / Zero key

In combination with the digital input (via terminal) and/or the zero key at the front, functions like e.g. HOLD, TARA or a channel switch-over, can be actuated. The digital input is available in combination with the option sensor supply or via an external 24 VDC-signal. The zero key at the front of the device can be activated by keypress.

6.4.1 HOLD function

The HOLD function is a static or keyed signal and is activated via the digital input or the zero key. It always takes effect on the reference value that is allocated in the display. With activated HOLD the lastly given measuring value remains and is by deactivation permanently overwritten by the measuring value recording. With this function a test state can be recorded beyond a specific period, so that this device can be used for control in run production, too.

Advice: HOLD value gets lost with re-start!

6.4.2 TARA function

The TARA-Function can be activated by zero key or digital input and needs to last for at least 3 seconds.Thereby the instantaneous value of the channels is set on zero and the difference to the actual value in PN4/PN9 (Offset displacement) is stored.This function is only done once, after actuation of the desired trigger and has to be taken back bevor anew alignment. The display reports this action by showing five little zeros in the display „*00000*“.

6.4.3 Configurable channel switch-over

The two input channels can be addressed via zero key, externally via the digital input or time-controlled. This enables the user to see different measuring values in display change mode under PN11.

6.5. Interace RS232 / RS485

All **PZ5** devices can optionally be programmed or configurated via an interface. Devices of the basic type do not have an interface.

Operating mode
The interface can be operated in various modes that can be parameterised via the PN34 (Interface behaviour).

PN34=0
Standard mode in which the unit only replies if called on to do so. This mode is used only for configuration. Furthermore the current measuring value can be recalled via commando "**A** ↵".

PN34=1
Transmission mode in which the measurements are transmitted via the serial interface cyclically with the set measuring time.

The transmission mode is interrupted on receipt of "**>** ↵" and the unit changes to standard mode. To change back to transmission mode, the display must be restarted, either by entering the command "**S** ↵" or by switching the device off and on.

With the transmission mode, the display value is transmitted via the interface in ASCII format. Minus signs and decimal points are also transmitted so that the output can be displayed directly on a terminal or processed by a SPS. Zeros at the front are suppressed during transmission. With an over or underflow, the display transmits horizontal bars (hyphens) "- - - - - ↵".

Examples: "0.00 ↵" ; "-9.99 ↵" ; "999.99 ↵" ; "-123.45" ; "- - - - - ↵"

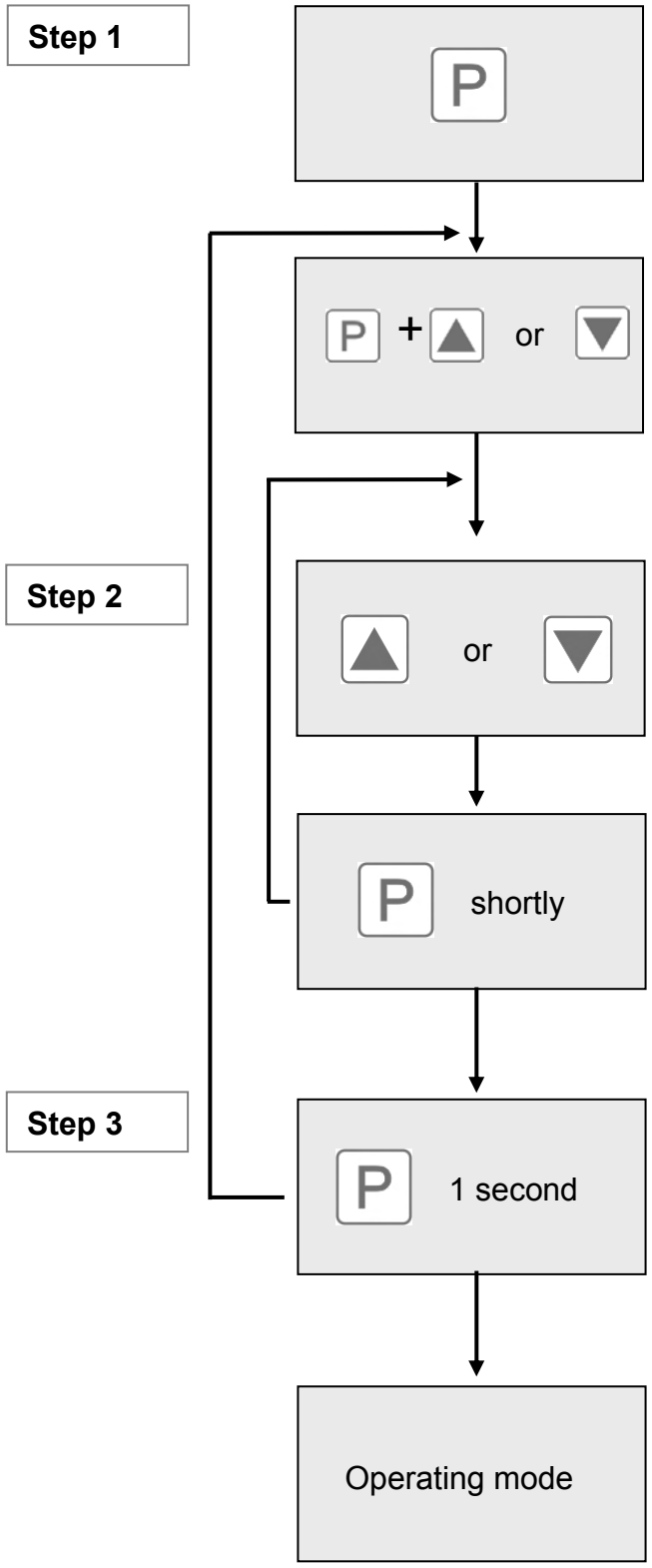
With the aid of this simple protocol structure, the display data can be transferred very easily to a PC etc. and further processed there. In the simplest case, a terminal program from the operating system is sufficient to store the received data in a file .

Configuration of the device via interface

For configuration the set-up tool **PM-Tool** can be used. As the communication is a straight point-to-point connection. The baud rate is set to 9600 baud, with 8 databits, without parity and one stopbit .
Configuration is performed by transmitting **ASCII symbols**.

7. Programming

Functional diagram of programming via key pad


Step 1
P
Call for program mode
Device jumps on the nervermost approved program number.
P + or
Change to the next program number
Program number is displayed.
Step 2
or
Change/read the deposited parameters in the program
Flashing of the least significant digit.
P shortly
Save parameter
Step 3
P 1 second
Save the complete range of parameters
Operating mode
After 7 sec without selection, device changes autonomous in the operating mode.

Description of the program numbers

In the display, the program numbers (PN) are shown, right-justified, as a 3-digit number with a **P** in front of them:

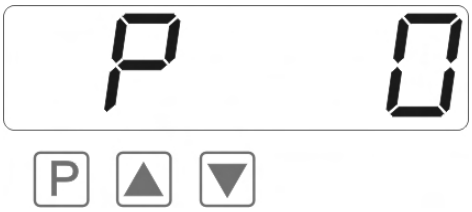
Display of e.g. program number 0

Programming procedure

The entire programming of the **PZ5** is done by the steps described below.

Change to programming mode

Push the **[P]** key to change into programming mode. The unit goes to the lowest available program number. If the programming lock is activated, the key must be pushed for at least 1 second.

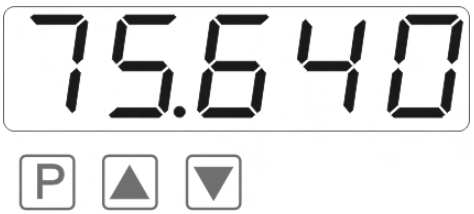


Change between program numbers

To change between individual program numbers, hold the **[P] key down** and push the **[▲]** key for changing to a higher program number or the **[▼]** key for changing to a lower number. By keeping the keys pushed, e.g. **[P] + [▲]**, the display will begin, after approx. 1 second, to automatically run through the program numbers.

Change to the parameter

Once the program number appears in the display, you can push the **[▼] or [▲] key** to get to the parameters set for this program number. The currently stored parameters are displayed.



In this case, it is 75,640

Changing a parameter

After changing to the parameter, the lowest digit of the respective parameter flashes on the display. The value can be changed with the [▲] or [▼] key. To move to the next digit, the **[P] key** must be briefly pushed. Once the highest digit has been set and confirmed with **[P]**, the lowest digit will begin to flash again.

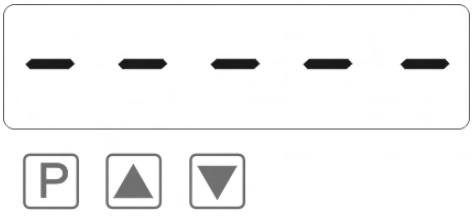
Example:
The 0 is flashing this is the lowest digit and asks if you want to change it. Let us assume the figure is to be changed from 75,640 to 75,000.
Briefly push the **[P]** key to move to the next digit. The 4 begins to flash. Change the figure by pushing [▲] or [▼] to change the digit from 4 to 0. Briefly push the **[P]** key to move on to the next digit. The 6 begins to flash. Change the digit by pushing [▲] or [▼] to move the 6 to a 0. Briefly push the **[P]** key to move to the next digit. The 5 and 7 do not need to be changed.

Saving of parameters

All parameters must be acknowledged by the user by pushing the **[P] key** for one second. The changed parameters are then taken over as the current operating parameters and saved in the EEPROM.

This is confirmed by horizontal bars lighting up in the display.

All the **newly entered data are confirmed** by the unit. If no confirmation is received, the relevant parameters have not been saved, e.g. confirmation of parameters:



Changing from programming to operating mode

If no key is pushed in the programming mode for about 7 seconds, the unit will return automatically to operating mode. Before „SAVE“ will be displayed untill the next measuring value is displayed.

Two measuring inputs with arithmetic function

The **PZ5** is provided with two standard inputs, which can be allocated via different types of arithmetic functions. The inputs need to be configurated, so the device works according to the signal that was generated by the sensor. The adjustment of the parameter that form the basis is done under PN0 and PN5.

Setting / Calibration of the measuring input

All devices are calibrated in the factory, whereby zero point and final value have been saved for the various measuring ranges. Via terminal connections and the choice of the measuring input under PN0, different types of input signals can be worked up.

Factory calibration current / voltage under PN0/PN5 = 1…3

For these parameters, scaled display values can be allocated to defined input values. For the adjusted measuring range, the final valueand the zero point need to be parametrised.

For parameterisation, no sensor signal has to be applied because stored values are used..

To display a sensor signal of 4...20 mA, for example PN0/PN5 =3 has to be parameterised.

Sensor calibration PN0/PN5 = 4/6

During sensor calibration the device is calibrated directly at the measuring section via the sensor signal or a calibrator. Therefor the measuring signal of the setpoint needs to be connected to the input of the device. Under PN1 (final value) and PN2 (zero point) the related display value (*SCALE*) and the related sensor signal (*INPUT*) needs to be stored. The sensor signal is measured by the factory parameter and displayed as current or voltage. A measurement needs to be started by shortly pushing the [**P**] key. By this process with 2 setpoints the device is aligned at the measuring section. For further adjustments to the characteristic line of the sensors, a linearisation can be activated.

Linearisation PN100 / PN140

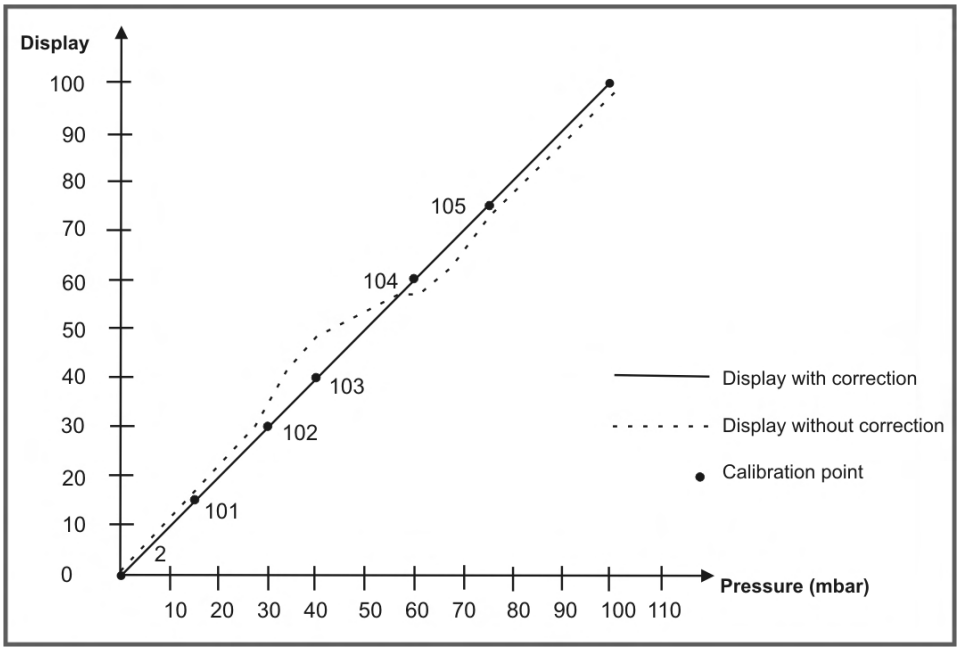
The **PZ5** offers the possibility to linearize, with up to 30 additional setpoints, non-linear sensors for the display of the measuring values and their subsequent processing (analog output).

The number of the desired setpoints is determined under PN100/PN140. Be aware of chosing the right one, as it can lead to a malfunction of the device in case of no adjustment.

Approach to sensor calibration for e.g. channel 1

To program e.g. 5 setpoints, 5 needs to be entered under PN100. Subsequently, for each of the calibration points, the measured variable must be applied to the unit and the respective display value needs to be parametrised under program numbers PN101 – PN105. The sensor signal needs to be parametrised strictly increasing. A distcance from at least + 1 Digit to the previous display value should be kept. If not, a rejection in the form of not receiving a memory report (- - - - -).
Our example shows the linearisation of a pressure transducer for 0-100 mbar with an output of 0-20 mA and an nonlinear range between 0-75 mbar. The display value is calculated from the known characteristic line of the transducer or determined empirically. This means, at a pressure of 15 mbar the transducer supplies 3.3 mA instead of the optimum value of 3.0 ma. As 20 mA of the display correspond with 100.0, 3.3 mA correspond 16.5 bevor correction. To make this correction, enter 15.0 under setpoint PN101.

Setpoint (PN)	Pressure (mbar)	Output transducer (mA)	Display bevor correction (IN)	Desired display (OUT)
2	0	0.5	2.5	0.0
101	15	3.3	16.5	15.0
102	30	6.2	31.0	30.0
103	40	9.2	46.0	40.0
104	60	11.4	57.0	60.0
105	75	14.7	73.5	75.0
1	100	20.0	100.0	100.0



Approach to factory calibration PN0/PN5 > 0

During adjusted factory calibration, a linearisation can be preset, without applying to the sensor signal. Here the desired number of channel setpoints needs to be entered under PN100 / PN140, in order to allocate display values to a defined measuring signal. Starting on setpoint PN101 the display value (Scale) and subsequent the corresponding measuring signal (Input) need to be programmed. Both actions are stored by pushing the **P**-key (for approx. 1 second).

Input channels and Offset

The **PZ5** device has two input channels, where standard signals (optionally 0...10 V, 0...20 mA or 4...20 mA) can be connected. Different signals can be collected for input signals, e.g. channel 1 collects voltage and channel 2 collects current. For each channel an arbitrarily measuring range can be set.

The offset displacement can be adjusted for each channel with PN4 and PN9. Thus an irregularity of the accuracy or drifts of sensors can be balanced.

Two channel measurement with calculation

The measurement happens in an alternating process, during this process it will be switched between the set measuring time and the two input channels. The time of the particular indivdual measurement depends on the parametrised measuring time.

Afterwards the two ascertained values will be allocated in accordance to the in PN15 selected function, and the result will be displayed. The arithmetic functions of the device are based on a floating-point arithmetic and include the parametrised comma in the calculation.

Single channel measurement

A single channel measurement is done, if one of the measuring channels is selected as display value via the PN15. In this case only the selected channel will be measured and displayed. That way, the measuring time PN14 can be set on a smaller value (100 ms). If 200 ms was adjusted by a two channel measurement, then this value will not be changed.

If the **PZ5** is parametrised on a one channel measurement, then the access to the program numbers of the deactivated channels is not possible.

The channel, on which no measurement is done and the arithmetic result receive the measuring/display value „0“ (Zero). Thereby setpoints or the analog output, which are parametrised on these channels, are shifted to a defined state.

Arithmetic functions

With the **PZ5** the measured values can be allocated with each other by different mathematical functions.

For the following examples, the values of the channels and the constants are defined as follows:

Channel 1	=	100,0
Channel 2	=	40,00
Constant	=	20
Display	=	xxxx,x

Addition (Channel 1 + Channel 2) * Constant

With this function, the two scale signals are added and subsequently multiplied by a constant.

Example: (100,0 + 40,00) * 20 = 2800,0

This function can be used to display inflow/outflow volumes, weighing technology, etc .

Subtraction (Channel 1 – Channel 2) * Constant

With this function, the difference from channel 2 to channel 1 is multiplied by a constant .

Example: (100,0 - 40,00) * 20 = 800,0

This function can be used to display differences etc.

Multiplication (Channel 1 * Channel 2) * Constant

With this function, the two scaled signals are multiplied with each other and then multiplied by a constant.

Example: (100,0 * 40,00) * 20 = 80000,0

This function can be used to display power, energy etc.

Ratio (Channel 1 / Channel 2) * Constant

With this function, the ratio is formed between the scaled signals of channel 1 and channel 2 and then multiplied by a constant.

Example: (100,0 / 40,00) * 20 = 50,0

This function can be used to display mixing ratios etc .

Percent (Channel 1 * 100 / Channel 2)

With this function, the scaled signal from channel 1 is multiplied by 100 and then divided by the scaled signal from channel 2.

Example: (100,0 * 100) / 40,00 = 250,0

This function can be used to display a percentage ratio .

8. Program number description

The **PZ5** device has a default configuration ex factory, where sensor signals are changed into a display value of 0…10000. At reset on default values should be done for devices, where their pre-configuration is not known, (*see chapter 9*). Otherwise different adjustments can cause an unwished behaviour of the device. These devices are equipped with a digital input, by which functions like e.g. HOLD, TARA, Min/MAX can be actuated.

Measuring input PN0/PN5

For basic configuration of the device, parametrise the suitable measuring input under PN0/PN5. Possible input types are listet in the program number table (*Chapter 8.1)*.

To assign characteristic lines into another device, use the settings 4/5 or 6 under PN0/PN5.
Under this parameter setpoints are deposited as standardized values (Current, voltage) and can be assigned by an optional interface into further devices.

Scaling of PN1/PN6 and PN2/PN7

PN1/PN6 and PN2/PN7 are used for the scaling of the device, with these two parameter, final value (PN1/PN6) and zero point (PN2/PN7) are parametrised. For each setpoint there is a *SCALE*–value and an *INPUT*–value. The *SCALE*–value indicates the desired display value. By use of the *INPUT*–value, the related measuring signal is set. At factory calibration the desired current or voltage value is preset. If sensor calibration is desired, a measurement is actuacted by shortly pushing the [**P**]-key. Before, the stored current or voltage value is displayed. All inputs need to be confirmed by pushing the [**P**]-key for approx. 1 second; the device confirms this by showing 5 horizontal bars.

Position after decimal point PN3/PN8

By changing this parameter, the position of the comma in the display is changed.

Offset translation / Zero point translation PN4/PN9

With this parameter it is possible to do a parallel translation of the parametrised characteristic line. This can be neccessary if e.g. a pressure sensor seasons by and by and thus causes a zero point translation. With corresponding parametrisation, the sensor can be adjusted on the zero point again. During offset translation, the original characteristic line can be programmed by the user with help of PN1, PN2 or PN101...130, or it can be the characteristic line of a temperature sensor. The value parametrised under PN4 is added to the original display value. If e.g. a temperature sensor shows 0°C instead of 3°C, you can compensate these irregularities by changing the value under PN4 from 0 to -3.
This parameter can be changed directly by taring, if it was acutated by the zero-key or the digital input.

Default display channel PN10

The **PZ5** can be parametrised and displayed on any display channel, independent of the calculation.
If the arithmetic function PN15 = 0 is deactivated, the channel value is set on zero.

Configurable channel switch-over PN11

This program number enables the user to see all measuring values of the channel and the arithmetic function during standard operation.
Therefor all different types of operation like e.g. a static, keyed or automatic display change are supported by the device.
Bevor each change of the channel, the device shows the name of the channel in the display. For channel 1 it displays „**Ch1**“ and for channel 2 it displays „**Ch2**“. For the arithmetic function it displays „**Ar**“, if it was activated by PN15 > 0.

The static and keyed channel swith-over can be triggered via the digital input or the fourth key. The selection is done via program numbers PN53 and PN54.

At the static channel switch-over it is changed as long on the via PN11 selected channel (PN11 = 1…3), as the related digital input or the zero-key is deactivated again.

At the keyed channel switch-over it is changed in the order “Ch1”, “Ch2” and optional “Ar” at each actuation of the defined activator.

During the time-controlled automatic channel switch-over the display jumps from one channel to the next following one during the preset time cycle (“Ch1”, Ch2” optional “Ar”). If the arithmetic function is deactivated (PN15=0), the display only changes between the two display values of channel 1 and channel 2.

Even at activated display change MIN-/MAX-values of the currently active display channel can be recalled via [▲]- and [▼]-keys. The channel switch-over is delayed by the MIN-/MAX-display time.

Display time PN13

Under display time the time is set, that shall pass between the update of the display. The longer the time between two display cycles, the optically calmer seems the display, whereas a display time of 1 second is found very pleasant.

Measuring time PN14

The device always executes a two channel measurement. For a measuring interval (adjustable via PN14) it is switched to and fro severable times between the input channels and by the individual measurements per channel, a simple arithmetic average detemination is used. The conversion time of the integrated AD-converter is aligned dynamically to the measuring time.

Set measuring time / s	< 0.25	< 0.5	< 0.8	> 0.8
Conversion time / ms	approx. 30	approx. 30	approx. 30	approx. 30

The AD-converter is equipped with a digital filter function, which suppresses very effectively a possible mains hum (50 Hz). To use this function, a measuring time from more than 0.5 seconds should be selected.

Arithmetic Function PN15

Under this function the calculation type of the channels is set. The different functions can be seen in the program number table *Chapter 8.1*.

The arithmetic function is completely calculated in floating-point-arithmetic. Thereto the scaled measuring values of both input channels are calculated and processed in floating-point-arithmetic, too. According to this the resolution of the single channels can be clearly higher than the display value. For the calculation a bit mantissa and a 8 bit exponent are used. For this reason the adjusted comma (PN3, PN8, PN17, PN18) need to be included at the calculation.

CAUTION!

The outputs work only with the display value and reach especially at the optional analog output only its resolution!

Zero point suppression PN18

At the zero point suppression, a value range around the zero point can be preset, so the display shows a zero. The amount that is effective comparably in the positive as in the negative range is parametrised in the program number. This can be neccessary if e.g. a rotation speed is collected by an analog sensor and this sensor shows a drift around the zero point. If the signal changes at idleness of the motor slightly, still a rotation speed of „0“ is shown. Marginally negative rotation speeds are suppressed.

Analog output PN20, PN21 and PN22

The parameter of the optional analog output apply to the scale of the device and are cyclical updated with the measuring time. Via PN22 = 0 the analog output can be deactivated, whereas it remains on its initial value after a re-start of the device.
The Analog output can be related to all other possible values that are collected in the device. For further information please see *Chapter 7* or the program number table in *Chapter 8.1*.
Initial value and final value are always displayed without comma. This is always based in the depiction of the measuring value in the display, this means at a depiction of e.g. 6.400 the final value can be parametrised by 6400 to this display value.

Interface behaviour PN34

The current display value can be sent via the optional interface. In standard operation PN34 = 0 the display stays passive and expects data from the Bus. This operation is suitable for the configuration of the device. At slowly processes the current measuring value can be recalled actively via command. During sending mode PN34 = 1, the current measuring value is sent actively by the device in the cycle of the measuring time. Further information can be found in *Chapter 7 / Operation mode*.

Security settings / User level PN50 to PN52

The access to the program numbers is controlled by the security settings. The user has only access to settings that were allowed by the plant operator, like e.g. the adjusment of the alarm thresholds. The smaller the numerical value of the under PN52 preset user level, the larger is the grade of the saving of the device parameter from user interventions.

User level PN52=		0	1	2	3	4	5	6	7	8
Access to:	**PN**									
Display brightness	19	X	X	X	X	X	X	X	X	X
Programming lock	50	X	X	X	X	X	X	X	X	X
Serial number	200	X	X	X	X	X	X	X	X	X
Alarm threshold value	61, 71, 81, 91	X	X	X	X	X	X	X	X	
Alarm parameter	59…95	X	X	X	X	X	X	X		
Interface parameter (Option)	32…34	X	X	X	X	X				
Analog output parameter (Option)	20…22	X	X	X	X	X				
Measuring input parameter	0…18	X	X	X						
Linearisation parameter for the measuring input	100…170	X	X	X						
Activation code	51	X								
User level	52									

The user level 1,3, 5 and 7 are reserved, at this parametrisation always the numeric higher user level is active (2, 4, 6 und 8).

The user level adjusted under PN52 is activated, as long as the programming lock **PN50** differs with the activation code **PN51** on a value basis. For dispatch of the **PZ5**, both parameter are set to the values 0000, by what the programming lock is deactivated.

To activate the adjusted user level, a 4-digit number needs to be entered as activation code under PN51. It needs to be confirmed by pushing the **[P]** key for approx. 1 second.

During the change into program mode the device jumps to the first program number that is available. If user level PN52 = 3 is parametrised, e.g. the access to the program numbers of the alarms is approved, a change of the measuring input PN0 is not possible for this setting.
To receive the access to all program numbers (PN52 = 0), the programming lock under PN50 and the under PN51 stored 4-digit activation code need to be entered again and to be acknowledged by pushing the **[P]** key for approx. 1 second. After this the access to all program numbers is free.

Caution! **If the locking code got lost, the device can be reset to the default value 0000 by the manufacturer, without any data loss.**

Digital input and/or zero key PN53, PN54

The digital input and the zero key can freely be related to additional functions (Change of display, Hold, Taring). Only by combination of activation and one additional function with activation of the related activator, the extended functionality can be used.

Taring PN55

During taring the instantaneous value of the selected channels is set on zero and the difference to the actual value is stored in program number PN4 respectively PN9. The taring function can be actuated via the digital input or the zero key and needs to stay activated for at least 3 seconds. The device reports the taring process by shwoing „ooooo“ in the display. The offset displacement is only related to the resolution of the display value! The taring can be undone by programming program number PN4 or PN9 to the value zero.

HOLD-Function PN56

At HOLD-function the current display value is recorded. An update of the device with a new measuring value is not happening any more. To display this state, the display flashes with the kept display value.
The HOLD-function can be activated keyed or static. During keyed mode, the HOLD-function is kept until the next activation, this is done by shortly and uniquely activating the actuator, which can be the digital input or the 4. key. During static HOLD the actuator needs to stay active for the whole length of time of the HOLD-function.
The HOLD-function and the display flashing to threshold values (PN12) use both the flashing of the display value. Both differ in the flashing frequency, which is clearly higher for the display flashing on treshold values. For a better differentiation and to aviod a mix-up, one should surrendor of one of both function as a rule.

Alarms / Relay PN59 to PN95

The behaviour of the alarms can be influenced by different program numbers. The general information refer to the scaled measuring value and are updated by the set measuring time. If the optional relays are included in the display, then they are connected parallely to the alarms. More details about the different parameter are described in *Chapter 6.2. Alarms/Relays* beschrieben.

Linearisation PN100 to PN130 and PN140 to PN170

By linearisation the user has the possibility to linearise a nonlinear sensor signal. A detailed description can be found in *Chapter 8 / Linearisation PN100 ≥ 0*.

Serial number PN200

Under PN200 the 5-digit serial number can be recalled; it describes an allocation to production process and production flow.

8.1 Program number table

The following program number table contains all program numbers (PN) including function, range of value, default values and user level.

PN	Function	Range of value	Default	User level
Channel 1				
0	Measuring input	0 = Sensor calibration 1 = 0…10 V (Factory calibration) 2 = 0…20 mA (Factory calibration) 3 = 4…20 mA (Factory calibration) 4 = 0…10 V (Sensor calibration) 5 = 0…20 mA (Sensor calibration) 6 = 4…20 mA (Sensorkalibration)	0	2
1	Final value / Fullscale	-9999…99999	10000	2
2	Initial value / Offset	-9999…99999	0	2
3	Comma setting	00000…0,0000	none	2
4	Offset displacement	-9999…99999	0	2
Channel 2				
5	Measuring input	0 = Sensor calibration 1 = 0…10 V (Factory calibration) 2 = 0…20 mA (Factory calibration) 3 = 4…20 mA (Factory calibration) 4 = 0…10 V (Sensor calibration) 5 = 0…20 mA (Sensor calibration) 6 = 4…20 mA (Sensor calibration)	0	2
6	Final value / Fullscale	-9999…99999	10000	2
7	Initial value / Offset	-9999…99999	0	2
8	Comma setting	00000…0,0000	none	2
9	Offset displacement	-9999…99999	0	2
General settings				
10	Default display channel	1 = Channel 1 2 = Channel 2 3 = Arithmetic function	3	2
11	Channel switch-over via digital input, zero-key or automatically	0 = none (▲- /▼- key) 1 = static change of display to channel 1 2 = static change of display to channel 2	0	2

11	Channel switch-over via digital input, zero-key or automatically	3 = static change of display to arithmetic function 4 = keyed change of display 5 = 5 s – change-over cycle 6 = 10 s – change-over cycle 7 = 20 s – change-over cycle		
13	Display time	0.1…10.0	1,0	2
14	Measuring time	0.20…10.00 s two channels 0.10…10.00 s one channel	0,20	2
15	Arithmetic function, only with 2 input channels K1 = Channel 1 K2 = Channel 2 Konst = Constant PN16/PN17	1 = K 1 * Konst 2 = K 2 * Konst 3 = (K 1 + K 2) * Konst 4 = (K 1 – K 2) * Konst 5 = (K 1 * K 2) * Konst 6 = (K 1 / K 2) * Konst 7 = (K 1 * 100 / K 2)	3	2
16	Constant	-9999…99999	1	2
17	Decimal places of the constant	0…4	0	2
18	Decimal places of the calculation	00000…0,0000	0	2
19	Display brightness	0…9 (0= bright, 9 = dark)	3	8
Analog output				
20	Final value for analog output (Option)	-9999…99999	10000	2
21	Offset value for analog output (Option)	-9999…99999	0	2
22	Reference value for analog output	0 = none 1 = Ch1 2 = Ch2 3 = arithmetic function	3	2
Interface				
34	Switching of the interface behaviour	0 = Standard operation 1 = Sending operation	0	4
Programming lock				
50	Programming lock	0000...9999	0000	8
51	Access code	0000...9999	0000	0
52	User level	0…8	8	0
Function of the special inputs				
53	Function of the digital input	0 = no function 1 = change of display 2 = Hold function 3 = Tara	0	2

54	Function of the 4. key	0 = no function 1 = change of display 2 = Hold function 3 = Tara	0	2
55	TARA-Function	0 = no Tara-function 1 = Tara-function on channel 1 2 = Tara-function on channel 2 3 = Tara-function on Ch.1&Ch.2	0	2
56	HOLD-Function	0 = no Hold 1 = keyed Hold 2 = static Hold	0	2
	Threshold behaviour of the LED-display			
59	Display flashing (approx. 0.5 seconds) No flashing Flashing at setpoint 1 Flashing at setpoint 2 Flashing at setpoint 3 Flashing at setpoint 4 Flashing at setpoint 1 and 2 Flashing at setpoint 3 and 4 Flashing at setpoint 1, 2, 3 and 4	 0 = not flashing 1 = flashing at 1 2 = flashing at 2 3 = flashing at 3 4 = flashing at 4 5 = flashing at 1 and 2 6 = flashing at 3 and 4 7 = flashing at 1, 2, 3 and 4	0	6
	Setpoint 1			
60	Reference value for setpoint 1	0 = none 1 = channel 1 2 = channel 2 3 = arithmetic function	1	6
61	Threshold	-9999…99999	1000	6
62	Hysterisis	1…99999	1	6
63	Type of operation: Quiescent current / Operating current	0 = Quiescent current 1 = Operating current	1	6
64	Switching delay	0.0…10.0 seconds	0.0	6
65	Type of delay	0 = none 1 = Switching-on delay 2 = Switching-off delay 3 = Switching-on/-off delay	1	6
	Setpoint 2			
70	Reference value for setpoint 2	0 = none 1 = channel 1 2 = channel 2 3 = arithmetic function	1	6
71	Threshold	-9999…99999	1000	6

72	Hyterisis	1…99999	1	6
73	Type of operation: Quiescent current / Operating current	0 = Quiescent current 1 = Operating current	1	6
74	Switching delay	0.0…10.0 seconds	0.0	6
75	Type of delay	0 = none 1 = Switching-on delay 2 = Switching-off delay 3 = Switching-on/-off delay	1	6
Setpoint 3				
80	Reference value for setpoint 3	0 = none 1 = channel 1 2 = channel 2 3 = arithmetic function	1	6
81	Threshold	-9999…99999	1000	6
82	Hysterisis	1…99999	1	6
83	Type of operation: Quiescent current / Operating current	0 = Quiescent current 1 = Operating current	1	6
84	Switching delay	0.0…10.0 seconds	0,0	6
85	Type of delay	0 = none 1 = Switching-on delay 2 = Switching-off delay 3 = Switching-on/-off delay	1	6
Schaltpunkt 4				
90	Reference value for setpoint 4	0 = none 1 = channel 1 2 = channel 2 3 = arithmetic function	1	6
91	Threshold	-9999…99999	1000	6
92	Hysterisis	1…99999	1	6
93	Type of operation: Quiescent current / Operating current	0 = Quiescent current 1 = Operating current	1	6
94	Switching delay	0.0…10.0 seconds	0.0	6
95	Type of delay	0 = none 1 = Switching-on delay 2 = Switching-off delay 3 = Switching-on/-off delay	1	6

Linearisation				
100	Number of additional setpoints channel 1	0…30	0	2
101…130	Setpoints 1...30 Channel 1	-9999 ... 99999		2
140	Number of additional setpoints channel 2	0…30	0	2
141…170	Setpoints 1...30 Channel 2	-9999 ... 99999		2
Information				
200	Serial number	0…99999	xxxxx	8

9. Error elimination

The following list gives the recommended procedure for dealing with faults and locating their possible cause.

	Error description	Measures
1.	The unit permanently indicates overflow.	• The input has a very high measurement, check the measuring circuit. • With a selected input with a low voltage signal, it is only connected on one side or the input is open. • Not all of the activated setpoints are parameterised. Check if the relevant parameter PN1/PN5, PN2/PN6, PN100/PN140… PN130/PN170 are adjusted correctly • The arithmetic result produces an overflow, see *Overflow / Underflow, page14.*
2.	The unit permanently shows underflow.	• The input has a very low measurement, check the measuring circuit . • With a selected input with a low voltage signal, it is only connected on one side or the input is open. • Not all of the activated setpoints are parameterised. Check if the relevant parameter PN1/PN5, PN2/PN6, PN100/PN140… PN130/PN170 are adjusted correctly • The arithmetic result produces an underflow, see *Overflow / Underflow, page14.*
3.	The word "*HELP*" lights up in the 7-segment display.	• The unit has found an error in the configuration memory. Perform a reset on the default values and reconfigure the unit according to your application.
4.	The display values change in very rough jumps.	• During division the measuring value of the divisor is very small, check the measuring circuit.
5.	Program numbers for input parametrisation are not available	• The programming lock is set on an user level, which does not allow the access. • A different sensor type has been parametrised under PN1/PN5, so the desired program number can not be parametrised.
6.	"*ERR1*" lights up in the 7-segment display	• Please contact the manufaturer if errors of this kind occur.
7.	The addressed digital input does not react.	• Measure the current of the digital input with a multimeter. It should be between 1 mA and 3 mA.
8.	Program numbers for the analog output PN20…PN22 are not accessible.	• The analog output is an option of this device type. If it is not assembled, then the program numbers are not shown.
9.	The device does not react as expected.	• If you are not sure if the device has been parametrised before, then follow the steps as written in the next chapter and set it back to its delivery status.

Reset to default values

To return the unit to a defined basic state, a reset can be carried out to the default values.

The following procedure should be used:

- Switch off the power supply
- Press button **[P]**
- Swith on the power supply and press **[P]** for approx. Further 2 seconds.

With reset, the default values of the program table are loaded and used for subsequent operation. This puts the unit back to the state in which it was supplied.

Caution!

- **This is only possible when the programming lock PN50 allows access to all PNs or "*HELP*" is shown in the display.**
- **All application-related data are lost.**